Astrophysics

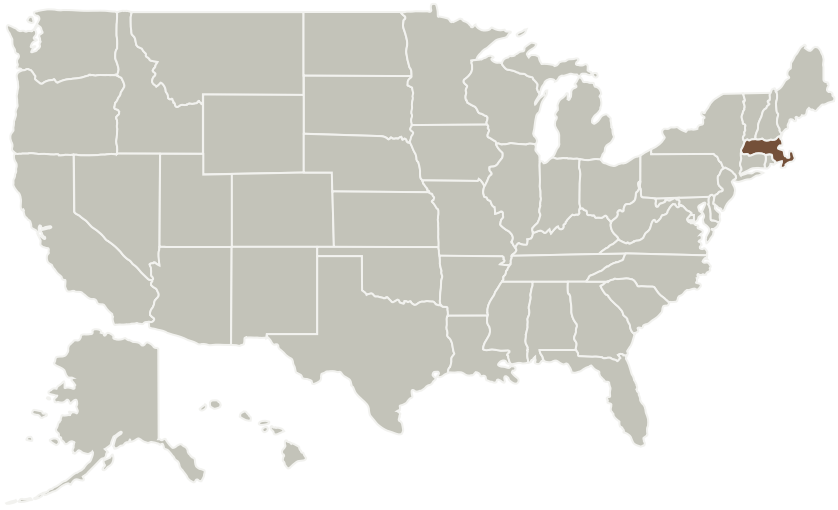
Moving Mesh Cosmology with Magnetohydrodynamics

Completed Technology Project (2016 - 2017)

Project Introduction

We propose to study the effects of magnetic fields on the formation and evolution of galaxies in a cosmological context using a new, state-of-the-art, moving-mesh numerical method for magnetohydrodynamics we recently developed (Mocz et al., 2014). In the first year of the project, we have implemented the numerical method in the AREPO code, and carried out initial simulations of cosmological boxes with primordial magnetic fields, as well as and isolated galaxies. We plan to continue pursuing the science goals by studying various initial strengths and topologies for the primordial magnetic field, and calculating it's effects on the Lyman-alpha power spectrum, Faraday rotation measurements, and galaxy evolution/structure and statistics. Our project supports the NASA program's broad themes (i) Physics of the Cosmos and (ii) Cosmic Origins, by gaining insight on how large-scale magnetic fields shape the structure and composition of the universe as a whole as well as on scales at the galaxy level.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Harvard University	Supporting Organization	Academia	Petersham, Massachusetts

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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Astrophysics

Project Management

Program Manager:

Joe Hill-kittle

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Primary U.S. Work Locations
Massachusetts

Project Management *(cont.)*

Principal Investigator:

Lars E Hernquist

Co-Investigators:

Philip Mocz
Karen Rizman

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

Target Destination

Outside the Solar System